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THE IMPORTANCE OF SPRINGS, SELF-FLOWING ARTESIAN WELLS, UNDERGROUND CAVE LAKES OF WESTERN KAZAKHSTAN IN TOURISM

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Abstract: The use of springs is becoming increasingly important in tourism. There are many springs in Western Kazakhstan that can be used to develop various types of tourism. Springs can be used for health, ecological, religious and other types of tourism. Today, health and spa tourism is one of the fastest growing sectors of world tourism. The historical and cultural heritage, and biodiversity associated with the springs also fascinate people, and many of them can become unique tourist destinations with high visual impact. The article gives characteristics of springs, self-flowing artesian wells, underground cave lakes of Western Kazakhstan and indicates their tourist potential for travellers and local. However, despite the high recreational potential of springs, tourism as a whole is not developed enough to provide quality tourism services and attract a large number of tourists to the region. An analysis of the tradition of tourist use of springs has been carried out and the main types of modern recreation are justified based on an assessment of the tourist potential of springs.

Key words: springs, self-flowing artesian wells, underground cave lakes, balneology, geotourism, natural hot springs, health and wellness spa tourism, religious tourism, West Kazakhstan

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INTRODUCTION

The basis for the development of domestic and inbound tourism in Western Kazakhstan is the effective integrated use of a rich natural heritage. Springs are one of the main elements of the recreational and resource potential of the region. In this aspect landscapes with the exits of fresh drinking, medical mineral and thermal waters are of great interest.

At the moment, many springs are used in tourism activities for health tourism, for instance thermal mineral springs in Turkey (Ozcelik et al., 2000; Karakaya and Karakaya, 2018), in China (Liu et al., 2021), in Iceland (Huijbens, 2011), in Japan (McMorran, 2008), in Australia (Jones et al., 2019), in the USA (Mueller et al., 2017). Springs are also actively used as objects of religious tourism (Egresi et al., 2012; Climo et al., 2017). Cold water springs around the world also provide valuable services to society, including irrigation and drinking water, the maintenance of biodiversity and habitat, and the provision of recreational and aesthetic values. Increased water production and other economic activities have led to the deterioration of many sources (Barquín and Scarsbrook, 2008). In the United States springs are also actively used as tourism facilities. For example, one of Florida's most picturesque natural resources is karst springs, once called "bowls of liquid light" (Wu et al., 2018). These springs are popular places for swimming, scuba diving, canoeing, picnicking and diving (Bonn and Bell, 2003). They are one of the oldest tourist attractions in Florida and are currently under threat due to increased groundwater abstraction from the Florida aquifer and pollution from various sources (Wu et al., 2018).

On the territory of Kazakhstan there are dozens of artesian pools with water of varying degrees of mineralization, having therapeutic properties and having a high temperature. A significant part of underground mineral and thermal waters has not been studied enough. Their use with rare exceptions is in the initial stage, and meanwhile many mineral waters of Kazakhstan have balneological properties. Resources must be carefully guarded and used for health purposes without loss.

Currently, in Kazakhstan, Russia and several other post-Soviet countries, mainly underground mineral waters are used for balneological treatment, which in recent years have been drilled in many new areas, sometimes from very deep depths. Springs and mineral groundwater were actively studied in Soviet times, for example, hydrochemical characteristics and typification of mineral springs opened by wells in Aralsk, Chelkar, Donguztau and several other areas of Western Kazakhstan were given (Sydykov, 1999; Mukhamedzhanov et al., 2020; Osipov et al., 2020). Springs belong to the most common and numerous water bodies, collectively forming an important part of the hydrographic network of the region. However, they are usually peculiar in terms of geographical conditions, historical heritage and are inhabited by specific flora and fauna, which makes them very attractive in terms of use as a tourist resource. The use of springs for tourism development is an important research task from both scientific and applied points of view (Erfurt-Cooper and Cooper, 2009; Boys et al., 2017). It is of particular importance for Western Kazakhstan, as a region with an arid climate and a

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shortage of water resources. However, despite the uniqueness of the natural complexes of the spring oases of Western Kazakhstan, their environmental characteristics and application in tourism have not been studied enough to date. It was mainly considered for recreational use and rarely for religious tourism (Akhmedenov, 2020). The aim of the study was to identify the possibilities of tourist springs and determine possible management models for the development of successful areas of sustainable tourism, with the main goal of preserving the natural heritage of Western Kazakhstan.

MATERIALS AND METHODS

Western Kazakhstan is one of the most dynamically developing regions of Kazakhstan, located on the border of Europe and Asia. The groundwater resource potential of Kazakhstan is characterized both by projected resources - the potential use of groundwater, the main share of which (up to 100%) is natural groundwater resources (underground runoff), and operational reserves of deposits and underground water sections. According to various estimates, the total estimated groundwater resources in Kazakhstan as a whole do not differ radically: from 61.8 km^3/year (Akhmedsafin et al., 1979) to 64.3 km^3/year. The bulk of the forecast resources of fresh groundwater (75%) is concentrated in the southern and eastern regions, 19% are concentrated in the central region, in the western region: Aktobe, Atyrau, Mangystau and West Kazakhstan regions - 6%; in the northern region - 1.2%. The climate of Western Kazakhstan is arid and semi-arid - in the south-western part, the average annual air temperature is + 10.5 ° C; in the northern + 2 sound+ 3.9 ° C. The amount of precipitation decreases from north to south from 300-350 to 150-200 mm. The maximum humidity is 33-60% (rarely up to 90%) and is observed in summer, mainly in the central and southern parts. In hydrogeological terms, it belongs to the Caspian hydrogeological region (Sydykov, 1999). The research methodology is based on a comparative geographical method, a method of retrospective analysis, applied on the basis of an interdisciplinary approach, based on the achievements of modern scientific knowledge in tourism, balneology, spa treatment.

The initial data for this work are obtained by studying published sources, collecting and processing stock and archival documents for the study of springs, the results of studies of mineral groundwater and artesians.

We have selected 7 springs in Western Kazakhstan because they represent the most characteristic types of springs in terms of geographical distribution. Information on water temperature, flow rate, chemical composition and availability of biota is collected in each spring. The obtained field data are supplemented by information from the literature.

They are often visited and they offer recreational opportunities both on water and on land. Three of them are located in the Mangystau region: Sauyr, Ystyk su, Karagan-Bosaga. Two in the Aktobe region: Upper and Sarzhansay Marzhanbulak, and one each in West Kazakhstan (Kyz aulia) and Atyrau regions (Tuzdybulak).

Field surveys of springs were conducted in 2012-2020 (Akhmedenov et al., 2013; Idrisova et al., 2018; Idrissova et al., 2019). An analysis of the sanitary and technical state indicators was carried out, the flow rate was determined, the coordinates of the spring were determined using a 12-channel GPS receiver of the Garmin eTrex model, pH, temperature and oxygen directly in the field. Also, an abris of the object was compiled, geological and geomorphological binding, a draft version of the spring passport was compiled, and the object was photographed. The content of nitrates, turbidity, hydrocarbonates, chlorides, sulphates, calcium, magnesium, permanganate oxidability, dry residue, total stiffness, sodium and general mineralization and other laboratory chemical analyses were carried out at the accredited test center of the Zhangir Khan West Kazakhstan Agricultural and Technical University. The results of hydrochemical indicators were compared with the regulatory documents of the Republic of Kazakhstan and the Russian Federation (Kurlyandsky and Sidorov, 2003; Korolev et al., 2003; Duisenova, 2015). In the course of our study, data on springs were supplemented, an analysis of their current state was made. Although this study focused on seven popular sources, their values could be used to infer the values provided by springs with similar characteristics.

RESULTS AND DISCUSSION

Springs are places where underground water emerges onto the Earth's surface, often forming a stream, pond, or marsh. In this study, we accepted under the term springs both natural and artificial exits of groundwater, as well as underground lakes in caves, which are also manifestations of groundwater. Artificial self-flowing artesian wells are also generically accepted as springs. According to typological classification of water currents (Illies and Botosanean, 1963), springs belong to a special zone – krenal. Authors of classification allocated several types of a krenal – limnokren (the spring with the expressed bowl), rheokren (a spring stream), a geokren (the place of diffusion unloading of underground waters which isn't followed by formation of a spring bowl or the constant course) (Figure 1).

A special kind of geokrens is gelokrens – the spring bogs which are formed in a zone of a seeping ground waters. Reokren pours out the waters on slopes or at foundation of hills, on slopes of river valleys or other erosive cuttings. Forms rather narrow and fast spring stream flows on a slope and usually falls into other larger reservoir. Limnokren forms at an exit a small flowing reservoir, so-called "bathtub" from which the stream follows. At the bottom of a limnokren bathtub, griffins on whom underground waters on a day surface arrive are often observed. A griffin – the water bringing channel (core) which comes to an end at a surface with the bowl-shaped hollow. The largest griffins the spring Kyz aulie (the Chingirlausky Region of WKP) forms (Figure 1) reaching diameter about a meter. Gelokren is characterized by the existence of small underground waters to rather plain surface therefore the fenny, boggy place is formed. The Tuzdybulak spring is a reokren, its waters flow into Lake Inder, the Sauyr spring is also a reokren, since brackish water comes from the stone walls, falling from the cornice in thin jets and flows into Lake Karakol. Geokrens are the springs Ystyk su, Sarzhansai, Marzhanbulak upper. Limnokrens are the springs of Kyz auliye and Karagan-Bosaga. Below we give a brief characterization of the 7 springs studied. The Kyz auliye spring is a unique natural

complex with Sarkyrama waterfall located in the sands, near the village of Aksuat, Chingirlau district, West Kazakhstan region. Spring water originates from the upper Cretaceous layer of the Poduralsky plateau. Sarkyrama - the waterfall feeds from a spring Kyz auliye, various tree-shrub plants grow abundantly around the spring and waterfall. The small waterfall (height 3.5 m) is located near the villages of Konyr and Karagash (formerly Aksuat). The Sauyr spring is located in the tract of Saur, Tupkaragan district of the Mangistau region. In the blue bay on the coast of the sea, a gorge with woody vegetation, shrub thickets attracts attention. Deep freshwater Lake Karakol is located in the depths of the gorge, which attracts numerous inhabitants (Figure 1). There is an isolated population of freshwater marsh turtle.

The thermal spring Ystyk su is located 15 km northwest of the village of Sarga on a plain in the Beineu district of the Mangistau region. Not far away are two pits and a sand quarry. The water tastes very salty and gives away a metallic taste. Vegetation is practically absent. According to local residents, earlier the source was actively used for medical purposes. The Karagan-Bosaga spring is an underground spring lake in the cave of the same name in the Karakiyan district of the Mangystau region. The upper spring Marzhanbulak is located 1 km from the village Marzhanbulak of the Alginsky district of the Aktobe region, equipped with an iron hood ring with a pipe. The Sarzhansai spring is a bottom spring of the river Elek of the Martoksky district of the Aktobe region (Figure 1). It has a southeastern extension. The spring tract is well equipped: gazebo, garbage cans, fenced. There is a potential risk of the spring functioning in connection with the construction of economic facilities near it. The Tuzdybulak spring is located on the north-eastern shore of Lake Inder of the Inder district of the Atyrau region, forms a wide valley overlooking the lake and watering the coast of Inder, along the banks of which there are many mud baths.

Figure 1. Location of research objects and types of springs of Western Kazakhstan:
1- Kyz auliye;
2 – Tuzdybulak;
3 – Sarzhansay;
4 - Marzhanbulak top;
5 - Ystyk su;
6 - well number 21;
7 – Sauyr;
8 - Balayuk cave;
9 - Karagan-Bosaga cave;
A - geokren (Sarzhansay spring);
B- limnokren (spring Kyz auliye);
C - reokren (Sauyr spring) (Source: Prepared by the authors, 2021)

The main tourism sectors using springs are: spa and wellness tourism, health and medical tourism, geotourism and ecotourism adventure tourism, nature-based tourism, sacral and religious tourism, speleotourism, agrotourism and ethnic tourism. Religious tourism has become increasingly popular in recent years. This type of tourism is associated with visiting religious shrines to meet the spiritual needs of tourists. Religious travel is an integral part of the modern tourism industry, and also plays a huge role in the system of international and domestic tourism. The objects of visiting religious tours are springs, spiritual centers, cathedrals and monasteries. Springs have been regarded as sacred, magical places haunted by spirits and thus have been the focus of special religious celebrations and ceremonies. Each region is famous for holy springs, many of which are known for miraculous power, so holy springs have great potential as objects of religious tourism.

Springs have the potential for sacred tourism, as objects that are a revered natural place of pilgrimage and worship, shows high spirituality and its origins in ethnic consciousness, a medium of information about the past and modern times.

Springs are a "place of memory" in space with unique landscape features associated with natural places, the traditional worldview of Kazakhs, and the most important values of consciousness in the history of ethnic groups. Numerous medical studies have provided evidence that the mineral properties of some kinds of spring water have therapeutic value especially for skin, arthritic, respiratory, and gastrointestinal ailments. Bathing in warm, mineral spring waters at spas has been and continues to be very popular worldwide. The scientific field of balneology has been established to explore the health benefits of these activities. Since the beginning of the 1990s environmental tourism begins to develop at a rapid pace. Springs are an excellent object for the development of ecotourism. Since springs have significant properties of ecological tourism: reversal to nature, use of mainly natural resources; environmental sustainability; focus on environmental education and education, on the formation of equal partnership with nature; concern for the preservation of the local socio-cultural environment; economic efficiency and sustainable development in the areas where it is implemented.

Spring tourism is often paired with other experiences as a marketing and visitor attraction tool. There is also often an overlap between springs environments and cultural/religious significance in many places. In spring tracts, agrotourism can be developed, providing for acquaintance with the folklore-ethnographic heritage and the traditional way of life of the rural population around the springs. A special type of resettlement is characteristic of the ethnographic region of Western Kazakhstan, where cattle breeding farms located near springs have been preserved. They preserve the ancient traditions of adaptability of the population to local environmental conditions, which gives rural settlements patriarchal-exotic features. Springs have long been important sources of drinking water, peculiar oases and played an important role in everyday life.

Rest on natural springs provides psychological détente, satisfies the aesthetic needs of people, and restores physical health. The names of springs often reflect their chemical composition (e.g., mineral springs, soda springs, and sulphur springs). Springs as visual attractions play a significant role in several tourism sectors. Springs for human use such as treatment for health conditions depend on factors like access, temperature, mineral content and a sustainable quality of the water. The following is a list of the range of springs that may be used:

1. Freshwater Springs - these are springs with clean fresh water. It is used as a source of drinking water supply. Their water is sometimes considered healing. They also serve as places for relaxation and recreation, swimming, diving and aesthetic enjoyment of the beauty of nature.

2. Saline Springs – spring water with a very high salt content is also used for many health spa facilities. Saline spring water spas have their own place in health and wellness treatments and are useful for treating skin conditions and joint problems and they are widely used for physical water therapies.

3. Hot Springs - commonly known for their curative powers and their therapeutic benefits. Hot Springs - warm water, with curative powers and they can be taken internally as well. Natural mineral and geothermal waters are used in balneology, balneotherapy, hydrotherapy and crenotherapy, which can be combined under the umbrella of thermalism.

Table 1 shows the conditions and possibilities of rest on seven springs of Western Kazakhstan.

Table 1. Characteristics of tourism springs in Western Kazakhstan.
Data source: (personal original data, and also Akhmedenov et al., 2013; Idrissova et al., 2019)

Name of the spring	Location	Flow rate, l/s	t oC	pH	Mineral-zation, g / l	Chemical composition	Practical use
Marzhanbulak top	Aktobe region, Alginsky district, 25 km from Aktobe, located 1 km from the village. Marzhanbulak.	0.1	13.2	6.97	0.28	sulphate-hydrocarbonate, calcium-magnesium	drinking water source, recreation
Sarzhansay	Aktobe region, Martok district, is located between the villages of Karatogay and Sarzhansay.	0.07	10.0	7.35	0.22	bicarbonate-calcium	drinking water source, recreation
Kyz auliye	West Kazakhstan region, Chingirlau district, near the village of Aksuat (Karagash).	0.1	14.0	7.75	0.31	bicarbonate-calcium	drinking water source, recreation
Sauyr	Mangystau region, Tupkaragan district, 53 km sout-heast of Fort Shevchenko, 71 km northwest of Aktau.	0.1	11.5	7.78	1.63	chloride-sulphate, sodium-potassium	balneological source
Tuzdybulak	Atyrau region, Indersky district, 17 km from Inderborsky settlement.	0.7	11.1	7.34	53.68	sodium chloride	balneological source
Ystyk su	Mangystau region, Beineu district, 15 km. from the village of Sarga, in the northwest direction.	0.5	52.0	6.16	159.73	chloride-sulphate, magnesium-calcium	hydrothermal spring
Karagan-Bosaga	Mangystau region, Karakiyansky district, 293 km east of Aktau, northern border of the Ustyurt reserve	0.3	14.0	7.87	3.95	sulphate-chloride, calcium-magnesium	speleotourism

In size of an output (expense) all explored springs belong to the class marginal (less than 1 p/a) (Table 1). According to the water temperature, the studied springs are cold (0-20 ° C), except for the Ystyk su spring, which belongs to very hot (more than 42 ° C). According to the classification of groundwater according to the hydrogen ion concentration indicator (pH), the studied springs are slightly alkaline (7.0-8.3), except for the Ystyk su spring, which belongs to weakly acidic (4.1-7.0) (Table 1). Depending on the general mineralization, the waters of the springs are divided into the following species: weakly mineralized (0.22-1.63, Marzhanbulak upper, Sarzhansay, Kyz auliye, Sauyr), small mineralization (3.95, Karagan-Bosaga), brine mineral waters (53.63, Tuzdybulak) and strong brine water (159.73, Ystyk su) (Manshina, 2004). According to the chemical composition, the water of the springs Marzhanbulak is upper, Sarzhansay, Kyz aulie is fresh (less than 1 g/l), the springs Sauyr and Karagan-Bosaga are brackish (1-25 g/l), the springs Tuzdybulak and Ystyk su are salty (more than 25 g/l) (Table 1). The sulphate-chloride, calcium-magnesium

composition of water in the Karagan-Bosaga spring is obviously associated with the fact that the waters are saturated with minerals after contact with gypsum or anhydride in the cave. The content of chlorides in the water of the Ystyk su spring exceeds the MPC value (350 mg/l) by 279.8 times. The highest value of calcium and magnesium was noted in the spring Ystyk su - 7100 and 900 mg/l, respectively. In the analyzed water samples of the Ystyk su spring, the total stiffness indicator exceeds the established standard (7 mg-eq/l) by 61.4 times. Oxidability characterizes the content in water of organic and mineral substances oxidized by a strong oxidizing agent. In the course of the studies, it was found that the oxidability is higher than the MPC value (5 mg/l) in the water of the Ystik su spring - 1.7 times. Analysis of the dry residue content revealed a deviation from the standard value (1000 mg/l) in Ystyk su - 113 times. A study of the ecological state of the springs showed that water samples of the Karagan-Bosaga spring did not meet hygienic standards, since it contained a significant amount of chlorides and sulphates, had significant values of total stiffness, dry residue, general mineralization, and an increased value of chlorides was recorded in the Sauyr spring.

A special group is represented by underground lakes fed by rising mineral waters. This includes Karagan-Bosaga Cave and Balayuk Cave. In the first lake, sulphate-chloride-calcium-magnesium waters with mineralization of 3.95 g/l have a temperature of 14°C. The lake in the Balayuk cave with a temperature of 6°C is characterized by sulphate-sodium-chloride-calcium waters and mineralization of 6.18 g/l. Thus, the studied underground lakes belong to the sulphate-calcium hydrochemical facies of karst lakes during mineralization > 1.25 g/l (Golubeva, 1953; Maksimovich, 1959).

In general, the studied springs are used by the local population for recreational and recreational purposes (Figure 2). 40-50 kilometers from the city of Aktau, in the Munailinsky district of the Mangystau region there is a radon source - well number 21 (Figure 3). Back in Soviet times, the local water was examined, and it was recognized that it corresponds in chemical composition to the famous Essentuki 17. Essentuki 17 - natural therapeutic chloride-hydrocarbonate sodium, boric drinking mineral water of medium mineralization (10.0-14.0 g/l). They like to come here, but the landscaping of local wells for tourists leaves much to be desired (rusty fence around the perimeter, lack of canopy and safe paths to the pool). There are always vacationers here, especially in the summer (Figure 2).

Springs in the territory of the Western Kazakhstan are places of concentration of biological diversity. They are unique habitats and by that make the significant contribution to a variety of a landscape and a biota (Pankov et al., 2008; Moroz et al., 2008; Abrosimova and Golovatyuk, 2011). Despite the territory insignificant by area, springs form the peculiar oases having unique features (Dedkov and Gunin, 2014; Davis et al., 2017; Cartwright et al., 2020).

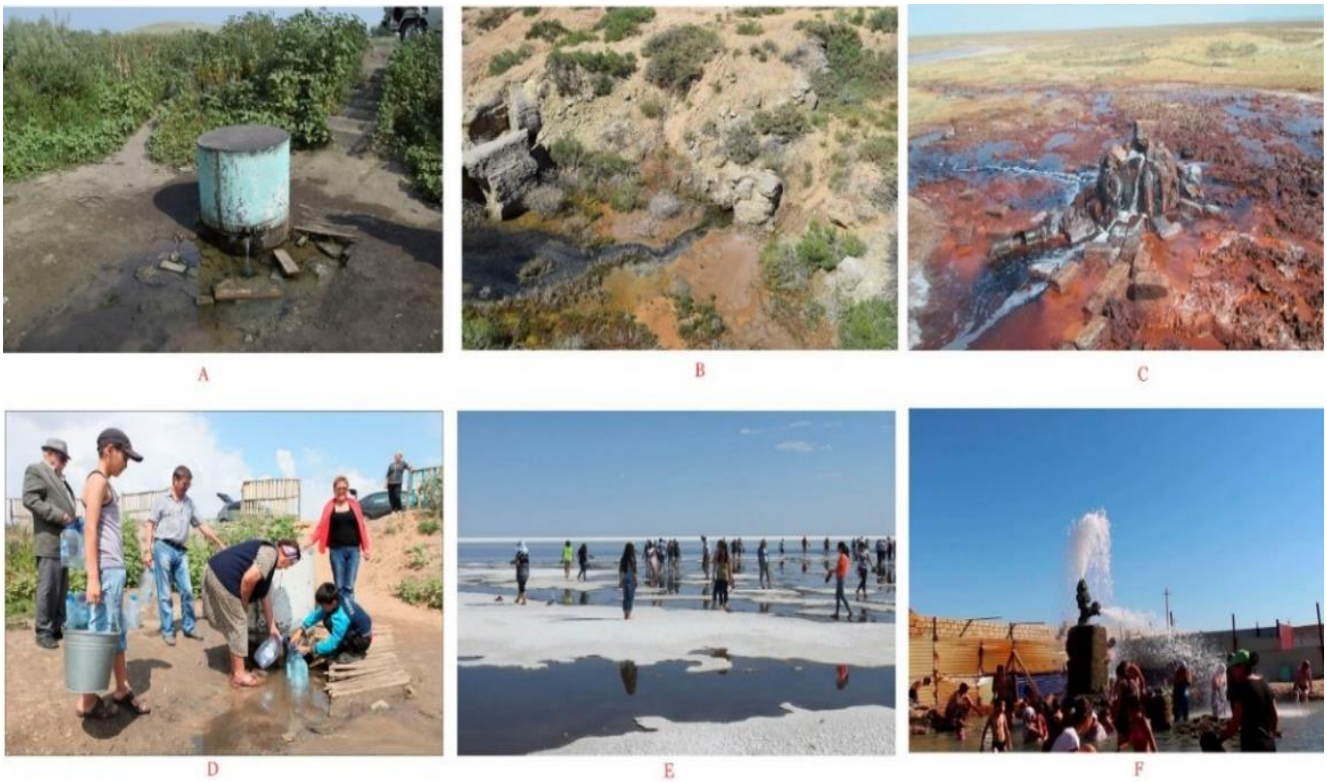

Figure 2. Recreational use of springs of West Kazakhstan: A- upper spring Marzhanbulak; B- spring Tuzdybulak; C - spring Ystyk su; D - a set of drinking water from the spring Marzhanbulak upper; E - mud treatment on Lake Inder, where the spring Tuzdybulak flows; F - reception of procedures with thermal water of Radon spring - well number 21 (Source: Prepared by the authors, 2021)

From the functional party these oases often are the only source of water resources in desert landscapes and, therefore, are concentrators of life and refuges of the majority of rare, endemic and relic species. The self-flowing artesian wells of the Western Kazakhstan for decades formed the unique microclimate, the area of thickets of reed and a cane on some sites is 5 hectares, with the internal system of small reaches. In general, a microclimate in the oasis is more contrast that creates a considerable biotopical variety for the development of plants and animals, than in the desert surrounding it. This

determines, as a result, the value of natural oases for the conservation of biodiversity in drought-tolerant environmental conditions of West Kazakhstan. Artesian wells drilled back in Soviet times are used as water supply by wild and domestic animals. Despite its small size, springs and artesian play an important role in the lives of many vulnerable and red-book species of birds and mammals (Kodric-Brown and Brown, 2007; Palacio-Núñez et al., 2007; Davis et al., 2017). Artesians are the dream of any ornithologist, because in a small area near the reservoir you can observe an amazing variety of birds. For some types of artesian - only a stop to restore strength on the path of migration, for others - this is a place of courtship, marriage dancing, and then breeding chicks (Karenina et al., 2015; Belyalov, 2017; Neruchev, 2018). Thermal springs play a key role for migratory birds and for some species serve as wintering places (Tymoshenko et al., 2019).

Springs can become birdwatching points and enter the map of tourist routes. Birdwatching or bird watching is one of the world's rapidly gaining popularity in environmental tourism (Puhakka et al., 2011; Czeszczewik et al., 2019). In the future, it is planned to develop birdwatching as one of the areas of scientific and environmental tourism in the territories of location of springs. According to the results of our research, it is possible to develop a comprehensive concept for the development of birdwatching at springs and artesian wells as a separate area of scientific and environmental tourism.

Springs can thus be actively used for the development of environmental tourism, they should be included in tourist routes and trails. It is also planned to create modern visit centers, glampings, campgrounds, ethno-auls and places for caravanning without capital construction, using light constructions. In rural areas where one type of tourist resource is lacking to act as a major source of attraction, the possibility of combining different types of attractions to increase attendance may be considered (Huang et al., 2016). In this regard, springs are a unique object for combining various types of tourism. On springs, specific types of tourism with national color can be developed, for example, equestrian tourism (Sigurðardóttir, 2018). In the conditions of spread on the territory of Kazakhstan in its numerous artesian basins, pressure groundwater, there are more than three thousand artesian wells (some fountain 40-50 years), the water of which either does not find use or is used in small volumes. The total flow rate of artesian wells is 0.4 km3/year (10% of proven reserves). Uncontrolled unregulated spawning of artesian wells causes significant damage to groundwater reserves, primarily fresh water, and in cases of opening of waters of increased mineralization, it negatively affects the environmental situation, leading to salinization of soils, successions of vegetation and waterlogging of territories.

All this requires adequate management decisions to prevent these negative events by switching wells to crane mode or their plugging (Poryadin et al., 2017). The need to keep existing artesian operational, as well as assess the possibility of creating new ones is required. In Kazakhstan, the amount of water received by the population from underground artesian and groundwater sources and used for household needs, animal husbandry and irrigation agriculture is 35.1%, of the total volume of fresh and weakly mineralized water consumed. Self-flowing artesian wells in the Atyrau and Mangystau regions can also be used not only for the development of tourism, but also as an alternative source of drinking water supply to the population. For example, in the Atyrau region there are 180 self-flowing artesian wells, of which 53 wells were equipped with adjustable gate valves, but now they are no longer working. In the Mangistau region, an inventory of the state of fountain wells was carried out in 1984 by the Mangyshlak regime party of the former Kazakh Hydrogeological Association. According to its results, in 1988-89, the Mangyshlak exploration expedition eliminated about 50 self-flowing artesian wells. Nevertheless, the total number of foundry wells in the Mangistau region is currently more than 250. The total flow rate of all the sewage wells available in the area is more than 100 l/s (8640 m^3/day) or 3154 thousand m^3/year. At the moment, all foundry wells have remained orphan.

The extraction of groundwater in all these areas and their free outflow through the foundry wells affects the groundwater resources of the region, triggering their reserves, and also contributes to various types of pollution of aquifers. Direct and indirect use of cold water sources brings a wide range of benefits to human society around the world, but such use of resources can also involve significant environmental costs, including loss of biodiversity and degradation of water quality. Despite the importance of sources, little attention has been paid to their management and conservation. A key element in the management and conservation of springs is the recognition of their position at the junction of three different ecosystems - groundwater, surface water and terrestrial. Human impacts on all three contributing ecosystems can have a significant impact on the integrity of the spring habitat.

Effective source management should take into account the full range of environmental and social values associated with them, understand the threats to the sustainability of those values and formulate strategies that balance potentially conflicting uses. As with any management strategy, a clear definition of the objectives of spring management is a prerequisite for effective conservation, protection and recovery (Barquín and Scarsbrook, 2008; Bhat and Pandit, 2020). Underground lakes are attractive for tourism in Western Kazakhstan in some caves of the region. In South Ustyurt there are karst and artificial caves of origin (Goltz and Epifanov, 1965; Potapova, 1974; Koshim et al., 2020). Artificial caves: Surule, Sultan epe, Ungoza, Kapam, Shakpak ata, Karaman ata, Shopan-Ata and others were created as a result of human processing of natural karst cavities and are actively used in religious tourism (Potapova, 1974; Yegemberdiyeva et al., 2018; Koshim et al., 2020). The best known are 2 natural caves Balayuk and Karagan-Bosaga with underground lakes (Figure 3).

One of the popular caves of the Western Kazakhstan is the cave Karagan-Bosaga at the foot of the Mount Baskaragan. Within the Ustyurt national nature reserve the cave of "Karagan-Bosaga" is poorly studied, its local name is "Zheroyyk". It is located on a slope sole. The entrance represents a roundish failure with a diameter about 8.0 - 10.0 m in the plan with sharply expressed brow (Figure 3). The cave impresses with the favor - an entrance from far away as specially made funnel, and close – inside – a step entrance. The cave is presented by one course consisting of the alternating the steeply inclined and horizontal sites. Inclined sites of corridor type from 6 to 10 meters high, with the step ceiling and an uneven floor covered with fragments and huge blocks of limestone. Walls - limestone, plaster layers.

The biggest hall is located at a depth of 160 m, comes to an end with the deadlock and is occupied with the small lake with a blue shade. Power of a hypsonic layer of 50-70 cm (there is a layer of plaster roses).

At a cave entrance a big failure. On all cave cracks with height about 1 m, depth of 7 m, goes down to 1.5 m, width on all cave of 8 m are observed. The left side of the cave is flat, and the right side - with an inclined plane and fragments. The thickness of fragments sometimes reaches 1 m. The cave of Karagan-Bosaga serves as the shelter during bad weather for representatives of fauna of the Ustyurt national nature reserve. Traces of mouflons are visible. In a distant part of a cave there is a small lake about 1.0-1.5 m in depth leaving under a wall (Figure 3). Crystal-clear and cold water. The area of a water mirror is about 4.0-5.0 sq.m. Water is considered sacred, water on taste bitter and salty here. It is possible to make ablution in the lake. Sulphate-chloride water as has obvious smack of plaster and a few chlorides. In a cave in process of removal from an entrance the humidity of air increases and reaches the maximum in a distant part at the lake. Air temperature in a cave is near +10° C (Golovachev, 2017).

Figure 3. Caves of West Kazakhstan with underground lakes: A - entrance to Karagan-Bosaga cave; B - an underground lake in the Karagan-Bosaga cave; C - entrance to Balayuk cave; D - an underground lake in the Balayuk cave (Source: Prepared by the authors, 2021)

The second cave - Balayuk Cave is located in the Aksaksaul tract in the southeast of the Ustyurt plateau, in the south side of the Kolyniyazkolka tract and 52 kilometers southeast of the Karynzharyk depression 350 km from the city of Aktau, 40 km south of Turkmenistan and 60 km east of Uzbekistan. Balayuk cave is located in a karst funnel 50 m long, 6-15 m wide, 7 m deep, in a southeast direction from the Balayuk cemetery, at a distance of 2.5 km from the Balayuk cemetery. Balayuk Cave begins with a small gallery, which very quickly slopes, expands and leads to the first hall to a depth of 28 meters. Going further, you will find another gallery and hall at a depth of 75 meters. Then there will be a steep descent of several meters and another gallery, which leads to the third hall at a depth of 120 meters. In this hall is a lake with beautiful blue water. The entrance to the cave is located in a karst funnel 50 meters long, 6-15 meters wide and about 7 meters deep. The cavity ends with a very vast lake, 20 m long, 10 m wide and 4.5 m deep. The cavity is dry all the way to the lake. The water of the lake is clear, slightly salted with a total mineralization level of 6 g/l. The air temperature in the cavity is 16 ° C, the water temperature in the lake is from 6 ° to + 13 ° C. The water in the underground lake in the Balayuk cave is clear, cold and has the following composition (g/l): sulphates -2.73, calcium - 0.57, magnesium - 0.38, sodium and potassium - 0.93, mineralization - 6.18. The lake is fed by the groundwater of the Lower Miocene aquifer (Potapova, 1974).

Tourist routes have been developed for the development of environmental tourism in which, the Sauyr springs described by us and the underground lake of the Karagan-Bosaga cave, are visited (Yegemberdiyeva et al., 2018).

Natural caves began to open for tourism more than 400 years ago, and now, probably, there are at least one, and often dozens of show caves in all countries of the world. There are about 800 large exhibition caves in the world with more than 50,000 visitors per year, and more than 250 million visitors annually pay to visit them (Lobo and Moretti, 2009; Garofano and Govoni,2012). Thus, the caves of Western Kazakhstan can now become one of the most important

geotouristic goals and represent an important economic resource for Kazakhstan. High-value geological formations are among the least-protected heritages of our globe. In the West Kazakhstan context, the study on geosites, geoheritages and geodiversity is at its infant stage. Springs and underground lakes in caves are certainly "geosites", i.e. geological or geomorphological sites with recognised value (Hose, 1995; Brilha, 2016). Geosite is a geological heritage site (Wimbledon, 1999; Ruban and Kuo, 2010). And they can be used for geotourism (Pralong, 2005; Dowling, 2011). The concept of geotourism was introduced in the early 1990's. The background of geotourism may be related to caves (Cardozo and Neto de Carvalho, 2013). Caves were the earliest tourist attractions, and nowadays one of the most appreciated geotourism destinations in the world (Anderson, 2010). At present, water bodies in Western Kazakhstan, including spring tracts, are becoming increasingly concerned about the general nature of the threat to public health and the state of natural ecosystems. The pilgrimage of those wishing to self-medicate grows every year, because our free medical care is inaccessible to many. Crowds of people suffering from skin diseases, musculoskeletal system every summer rush to the springs of Western Kazakhstan and as a result di-bone not only with excessive (excessive in time and temperature) use of spring resources, rapeseed and grains, but also in behavior on the shores. On freshwater springs, almost all pilgrims collect water, and many of them wash directly at the source. Improving the environmental situation on the springs of Western Kazakhstan is impossible, without the mouth of order in the tourist sector of water use.

CONCLUSION

Springs are an integral part not only of the natural heritage of the region, but also an object of water supply and recreation, therefore, an assessment of the quality and condition of the spring is a prerequisite for providing the population with drinking and therapeutic water that meets sanitary and hygienic requirements. All the above-described springs of West Kazakhstan can be included in tourist and excursion routes when designing a regional tourist product and will be used in the future by tourist companies, public associations of tourists for travel planning, as well as institutions for additional education of children of ecological and tourist orientation. It is necessary to continue recording, certification and comprehensive study of springs. Special research, from the point of view of balneotherapeutic properties, requires mineral waters and springs. It is necessary to develop a network of ecological tourist routes and trails, natural methods for protecting these trails from natural destruction, as well as protecting springs with clean water. The description of ecological routes may include traditions and crafts of the people, thus, the implementation of projects for the development of tourism will also contribute to the popularization of natural monuments and ethnocultural traditions of Western Kazakhstan.

It is necessary to provide for the restoration of destroyed sections of hiking trails leading to springs, waterfalls and other natural monuments, as well as the arrangement of recreation areas near the springs. We propose a number of measures for the most rational use and protection of springs. For example, given the uniqueness of the objects studied, it is possible to organize small visit centers (with a shower and beds for overnight accommodation in accordance with the throughput) in the ethno style and around it areas for installing tents and yurts. It is necessary to regularly clean the reservoir (spring bath) from household garbage and other foreign objects. Waste containers and toilets shall be installed in the surrounding area. Periodically clean and remove garbage. In our opinion, as well as in accordance with the provisions on water protection zones and coastal lanes, and taking into account the uniqueness of the natural object, we propose to have small architectural forms of a recreation area over a distance that do not adversely affect the ecosystem of springs. Restrict citizens' access directly to the source of the spring in the main bath, fencing it at least within the 20-meter zone around the main bath. Pilgrims' access to water for washing is indicated downstream of the stream. To take water directly from the main bath, install a mechanical pump, with water withdrawal outside the fence. Thus, springs should become not only alternative places for drinking water supply to the population and an excellent resting place for local residents, but also a base for the development of tourism. All these events will allow rational use of springs for tourist purposes, as well as for users of various state departments and republican departments. Tourist and recreational activities at the springs should be aimed at increasing the employment of the population, creating comfortable conditions for the development of tourism and recreation, and most importantly at restoring and improving the health of the nation.

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